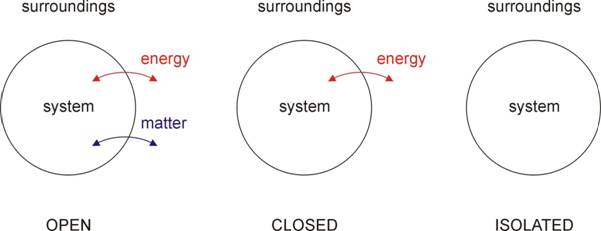
**Systems: Open, Closed and Isolated**

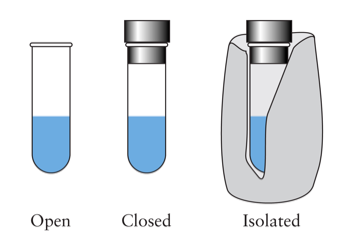
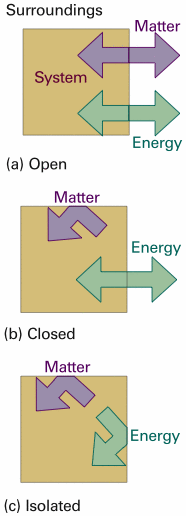
A system is separated from its surroundings by a well defined boundary. Systems may be defined as open, closed or isolated, depending upon whether energy and/or matter can be exchanged with the surroundings.

**Figure 1: Open, Closed and Isolated Systems diagram 1**



Source: Bristol University, 14th May 2008. Chemical Interactions – Systems.   
URL: <http://www.chm.bris.ac.uk/~chdms/Teaching/Chemical_Interactions/page_popup23.htm> Accessed June 22, 2012

**Figure 2: Open, Closed and Isolated Systems diagram 2**



Source: University of Massachusetts Amherst, 19th Feb, 2008. Internal Energy.

URL: <http://www.chem.umass.edu/~botch/Chem122S08/Chapters/Ch6/InternalE.html>

Accessed: 22nd July, 2012

**Figure 3: Open, Closed and Isolated Systems diagram 3**

Source: Queens University, 7th April 2010. Chem 221 Notes. URL:<http://www.chem.queensu.ca/people/faculty/mombourquette/Chem221/3_FirstLaw/InternalEnergy.asp> Accessed June 22, 2012

**Thinking and applying…**

1. Classify each of the following as being open, closed or isolated systems;

|  |  |  |
| --- | --- | --- |
| # | System | Classification  (open, closed, isolated) |
| 1 | A beaker of gently heating water over a Bunsen burner without a lid on |  |
| 2 | A beaker of gently heating water over a Bunsen burner with a lid on |  |
| 3 | A thermos filled with heated water |  |
| 4 | A plant |  |
| 5 | A human being |  |
| 6 | An animal cell |  |
| 7 | The pacific ocean |  |
| 8 | An aeroplane in flight |  |
| 9 | Earth |  |
| 10 | Our solar system |  |
| 11 | The universe |  |

2. On figure 2 on the previous page, draw and label arrows for matter and energy on each of the 3 images.

3. Figures 1,2 and 3 are all depictions of the same concept – the three types of systems – open, closed and isolated.

i) What are the strengths and limitations of each of the diagrams?

ii) Justify which you feel is the best for modeling the concept of open, closed and isolated systems.

4. Watch: <http://www.ted.com/talks/jane_poynter_life_in_biosphere_2.html>

i) What are the challenges of a project such as Biosphere II from various viewpoints; economic, social, cultural, political, environmental?

ii) Do you feel it is necessary for projects such as Biosphere II to be undertaken? Justify your point of view.

ii) Given that Earth is a closed system, what implications are there for our use of Earth`s resources (such as water, air, forests, soil, ores, etc)?